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Air Pollution

Air pollution refers to any physical, chemical or biological change in the air. It is the contamination of air by harmful gases, dust and smoke which affects plants, animals and humans drastically.

There is certain percentage of gases present in the atmosphere. An increase or decrease in the composition of these gases is harmful to survival. This imbalance in the gaseous composition has resulted in an increase in earth's temperature, which is known as global warming.

The incomplete combustion in the engine of a vehicle leads to emission of different gases contributing to increase in the pollution and adversely affecting the environment. Detection and control of these gases is an important area of work. This emission from vehicles cannot be completely avoided but, it definitely can be controlled. Now a day's accidents are common reason for deaths. These are critical things to control so here we come up with a concept to reduce pollution and detect the location of accident using GPS. As a solution to the above problems we aim to build an automated control system for emission level control of vehicle and accident place detection. Smoke detector is used to detect the carbon percentage in the smoke released by the vehicle due to combustion of fuel in it. Smoke detector is fixed at the end of the exhaust of vehicle from where smoke is released into the environment. The smoke detector detects carbon and gives it to the Microcontroller to check the maximum percentage of carbon content in the smoke released by vehicles. Temperature sensor can be used to sense the temperature in the vehicle. So the controller checks the percentage of carbon and temperature, if it exceeds the threshold level the system gets triggered and the engine comes to hault state and then it sends SMS about this to the nearby pollution control office through GSM.

Abstract:

Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond the standardized values. The primary reason for this breach of emission level being the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided, but it definitely can be controlled. The aim of the project is to monitor and control the pollutants in the vehicle by using the pollution control circuit. This pollution control circuit consists of various sensors like smoke sensor, temperature sensor and GSM, GPS kind of devices, and all of them are integrated and connected to a Controller. It is a real time work where a demo application has been made in which ARM 7 processor is used and a controller board is made where all these devices get integrated and work accordingly. The vehicle is controlled by this circuit. When a vehicle attains certain threshold pollution level then the engine gets automatically switched off and an SMS is generated and sent to the pre-defined number stored in the memory through the GSM module. The GPS module is used to locate the vehicle position where it is halted. This paper demonstrates an effective utilization of technology by which we save our environment by controlling the pollution of vehicles.

Team / Group Formation:

We hereby declare that the project entitled *"Air Pollution Control in vehicles"* ***submitted in partial fulfillment for requirements of the Design Creative & Thinking Lab completed under the guidance of*** *prof. Saumya Chaturvedi,* ***Sharda University is an authentic work.***

S. No	Student Name	Roll Number	System ID	Role
1	Abhishek Bhardwaj	210101024	2021001136	Developer / Designer
2	Ankit Kumar Deo	210101083	2021370540	Developer/ Tester

Technologies to be used:

- Software Platform

a) Front-end:

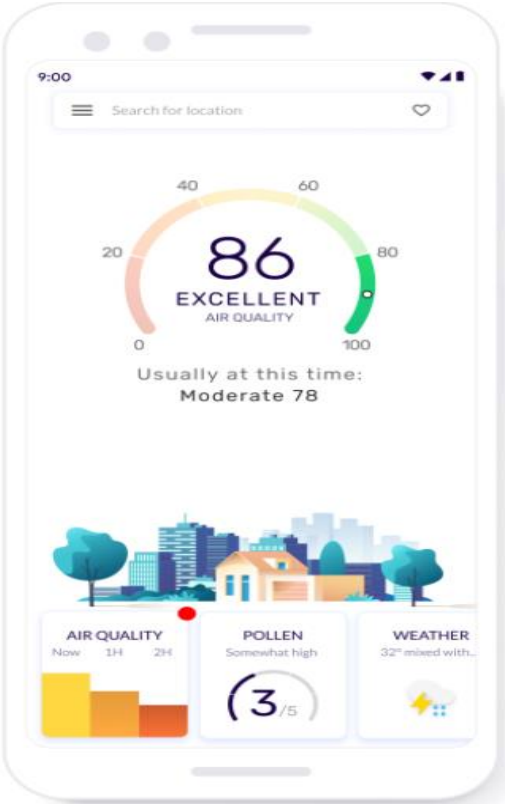
HTML5: HTML5 is a markup language used for structuring and presenting content on the World Wide Web. It is the latest and most enhanced version of HTML.

CSS3: Cascading Style Sheets (CSS) is a style sheet language used for describing the look and formatting of a document written in a markup language.CSS3 is the latest standard of CSS.

Javascript: JavaScript is a full-fledged dynamic programming language that, when applied to an HTML document, can provide dynamic interactivity on websites.

JQuery: JQuery is a cross-platform JavaScript library designed to simplify the client-side scripting of HTML. JQuery is the most popular JavaScript library in use today. b) Back-end PHP: PHP is a server scripting language and a powerful tool for making dynamic and interactive Web pages.

MySql: MySQL is an open-source relational database management system (RDBMS). It is very fast, reliable, and easy to use.



b) Back-end:

PHP: PHP is a server scripting language and a powerful tool for making dynamic and interactive Web pages.

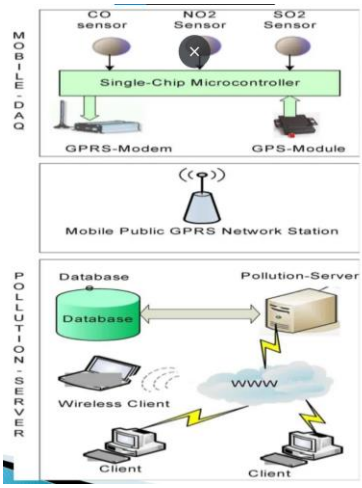
MySql: MySQL is an open-source relational database management system (RDBMS). It is very fast, reliable, and easy to use.

Application Platform

The project design is a part of the implication that can be used to improve the waste management of a locality. All the technical aspects have been thoroughly designed keeping all the constraints in mind. The project resolves around whether the project will be able to meet the future needs of the users. This project-based on IoT gives users the freedom of changing hardware as well as software specifications as per the arising need. IoT based projects are already designed while keeping future demands in mind and in a rising economy like India where the concept of smart cities is new the demand for our project will keep on increasing. This project here is a model of the large-scale application which spans pan India in different smart cities. The implementation of this project has been divided into various phases. Starting from the metropolitan cities and moving towards the concept of smart cities, it will also cover small towns and tier III cities in later phases. At present, we are here to display the live working of the model and give an idea about the actual implications. For any society to flourish, it is manifestly important that they remain fair and orderly. Deciding how best to ensure this, in light of the huge growth in both the uptake and complexity of technology that has occurred in the last decade, and which can be expected to continue in the next, this here is one of the products that can be used to contribute to the better management of waste and increase the efficiency of resources.

Hardware Platform

- SYSTEM HARDWARE BASIC BUILDING BLOCKS



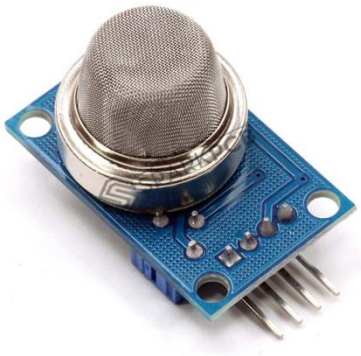
- HARDWARE REQUIRMENTS:

  Sensors to read the amount of pollutants emitted by the vehicle.

  Single - Chip Microcontroller to connect all the sensor so they can be used from a single place.

Tools:

- Sensor: The **MQ-135 Gas sensor** can detect gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and other harmful gases and smoke. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin. When the level of these gases go beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.



Price: Rs.200 to 500 per piece

- Single - Chip Microcontroller: A single chip microcontroller is a programmable device that contains CPU, retentive program memory and data memory, counters, and i/o such as digital inputs and outputs and analog inputs and outputs. It also includes a way to load the program memory and any configuration registers through means such as a JTAG port or similar.

Price: Rs.400 to 800 per piece

- Software:

  Android Studio

  Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.

  Requirements:

  Windows

  • 64-bit Microsoft® Windows® 8/10

  • x86_64 CPU architecture; 2nd generation Intel Core or newer, or AMD CPU with support for a Windows Hypervisor

  • 8 GB RAM or more

  • 8 GB of available disk space minimum (IDE + Android SDK + Android Emulator)

  • 1280 x 800 minimum screen resolution

  Android

  This software is compatible with android starting from version 11.

Problem Statement:

There are a number of ways in which the volume of harmful emissions can be reduced. These include encouraging fewer road traffic journeys, active transport for individuals undertaking relatively short journeys, the use of mass public transit in preference to individual vehicles, and alternative energy sources for vehicles, including electric and hybrid technologies. Where vehicle use is essential, means of reducing harmful emissions should be used.

Physicians around the world are aware of air pollution. It impacts the quality of life for hundreds of millions of people worldwide, causing both, a large burden of disease as well as economic losses and increased health care costs. According to WHO estimates, in 2012, urban outdoor air pollution was responsible for 3.7 million annual deaths, representing 6.7% of the total deaths (WHO, 2014).

Especially, diesel soot is acknowledged as a proven carcinogen (IARC, 07/2012). Furthermore, it has many other toxic effects, most prominently in the cardiovascular (Brook et al., 2010) and respiratory systems (ERS, 2010). Moreover, in the context of global warming, soot, along with methane, is identified as the second most important greenhouse driving force substance after CO2 (Kerr, 2013).

Despite the fact that new vehicles will have to comply with stricter emission standards which take into account most harmful ultra fine particles too, a high-polluting in-use fleet, including off-road vehicles such as construction engines and ships, will continue polluting for many more years.

Literature Survey

- **BY CHINA GOVERMENT**

  An experimental tower over 100 meters (328 feet) high in northern China — dubbed the world's biggest air purifier by its operators – has brought a noticeable improvement in air quality, according to the scientist leading the project, as authorities seek ways to tackle the nation's chronic smog problem.

- **BY INDIAN GOVERMENT**

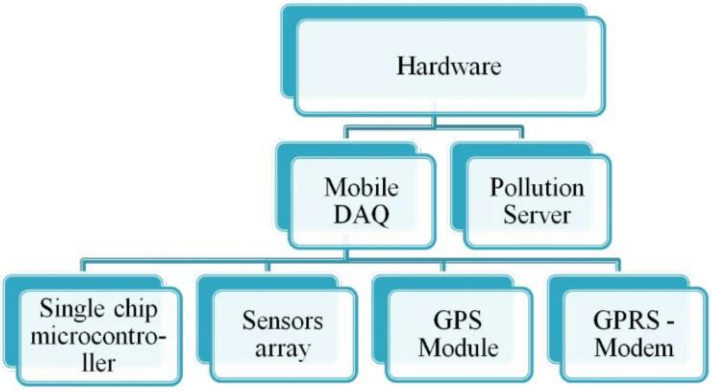
  In Delhi, Kurin Systems is developing a 12-metre (40 ft) tall smog tower, called the "Kurin City Cleaner". It is claimed the tower will filter air for up to 75,000 people within a 3-kilometre (1.9 mi) radius.The Delhi smog tower is 24 meters tall and includes 40 large fans. The air is sucked in from the top and the filtered air comes out from the bottle of the tower. The tower consists of 10,000 filters to filter out particle sizes up to 0.3 microns. The Delhi government claims that this smog tower can deliver clean air up to one thousand cubic meters per second. It also uses 8 sensors to measure the air quality before and after filtration.

- Over the years, there have been several regulations made by the Government to control the emission from vehicles; most of them being unsuccessful at the same. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests. Bharat stage emission standards are emission standards instituted by the Government of India to regulate the output of air Pollutants from internal combustion engine equipment, including motor vehicles. The first emission norms were introduced in India in 1991 for petrol and 1992 for diesel vehicles. These were followed by making the Catalytic converter mandatory for petrol vehicles and the introduction of unleaded petrol in the market. On April 29, 1999 the Supreme Court of India ruled that all vehicles in India have to meet Euro I or India 2000 norms by June 1, 1999 and Euro II will be mandatory in the NCR by April 2000. Car makers were not prepared for this transition and in a subsequent judgment the implementation date for Euro II was not enforced. The standards, based on European regulations were first introduced in 2000. Progressively stringent norms have been rolled out since then. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations. Since October 2010, Bharat stage III norms have been enforced across the country. In 13 major cities, Bharat stage IV emission norms are in place since April 2010.

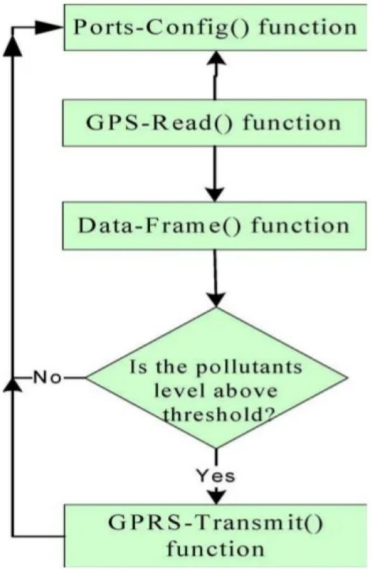
  In this paper, the semiconductor sensors have been used to detect the pollutant level of the vehicles. This Paper concentrates mainly on three blocks; smoke detector, microcontroller and fuel injector. The smoke detector detects the pollutants (CO, NOx, etc.) continuously. The microcontroller compares the level of pollutants with the stipulated level allowed by the government. When the pollutant level exceeds the standardized limit, it sends a signal to the fuel injector. On receiving a signal from the controller, the fuel injector stops the fuel supply to the engine after a particular period of time.

Project Modules: Design/Algorithm

SYSTEM DESIGN:



MOBILE DAQ SOFTWARE ALGORITHM:



AIR QUALITY DESCRIPTION

- AQI = (Pollution level / Pollution Standards) * 100

Index	Air Quality Description	Band
0-100	Clean Air	
101-125	Light Pollution	
126-150	Significant Pollution	
150 above	Heavy Pollution	

Implementation Methodology

The method couples an emissions estimation procedure to a traffic flow database. It requires data on emission factors, the composition of the vehicle fleet, vehicle control technologies and the daily traffic flow profile. With these data, it is possible to generate emission estimates per kilometre, link or road as selected by the user.

Each car must be equipped with Air quality sensor

The air quality sensor is part of the air conditioning system. It measures pollutants, in the form of oxidisable or reducible gases, in the air outside your car. Oxidisable gases include carbon monoxide, hydrocarbons (vapours from benzene or petrol) and other partially burnt fuel components.

Applying IoT Technology in Healthy Buildings

- Air quality is one of many different metrics Infogrid's end-to-end sensor systems monitor in real time. The company's cloud-based platform helps building managers capture information that didn't previously exist.
- Consider one of Infogrid's large financial institution customers. The company wanted to change its water management procedures across 550 sites. **Using Infogrid technology they were able to avoid sending fully trained engineers out once a month to run every tap, at every site.** Sensors now provide the granular understanding needed to predict failures.

Result & Conclusion

The signals acquired from the smoke sensor are compared with the user defined set point crossing the threshold limit the pollution level gets displayed in the LCD and when it exceeds the set point it gives a buzzer indication following the motor gets off.

The concept of detecting the level of Pollution and indicating it to the driver is implemented. There is an increase in the level of Pollution over the last couple of decades, leading to several Environmental problems. There will be a huge population, who do not take care of the pollution from their vehicles seriously, which has already resulted in several environmental problems such as Ozone layer depletion and so on. Hence this system will be highly beneficial in curbing this problem.

Future Scope and further enhancement of the Project

With the help of this project, we can reduce significance amount of pollution emitted by the vehicles.

This same concept can also be used in different places to measure the air quality of the place.

Advantages of this Project

01. *Monitoring System for Indoor Air Quality It's surprising to learn that indoor air pollution kills almost 3.8 million people each year. When particulate matter and hazardous gases are present in the air, the quality of the air is lowered, which may lead to serious illnesses such as asthma, lowered lung function, and even cancer when breathed.*

02. *Monitoring System for Outdoor Air Quality For decades, environmental health has been a hot subject. To maintain good air quality, many laws and regulations relating to pollutant emissions in the air have been established. As a result, companies must monitor the production of hazardous gases to maintain the emission rate well within the established standards.*

03. *Monitoring of Particulate Matter Particulate matter (PM) or Particulates are tiny particles floating in the air that are solid or liquid. These particles, also known as aerosols, are invisible to the naked eye and can be made up of a variety of materials such as acids, metals, dirt, dust, organic compounds, and so on.*

04. *System for Detecting Gases: Even a tiny leak may cause a disaster in sectors like chemicals and oil & gas, where hazardous gases and poisons are either utilized or generated in or during industrial operations. Long periods of time spent working in the presence of H2S or SO2 can harm a worker's respiratory system.*

References

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- *K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi "Investigation of gas sensors for vehicle cabin air quality monitoring," vol. 42, pp. 167-175, 2002.*
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